Test Date: 02/09/2020

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Test Time: 9:00 AM - 12:00 PM

Q.1 An amplitude modulated wave is represented by the expression

$v_m = 5(1 + 0.6 \cos 6280t) \sin(211 \times 10^4 t)$ volts

The minimum and maximum amplitudes of the amplitude modulated wave are, respectively :

Options

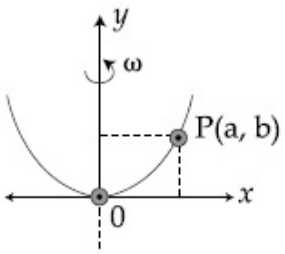
1. $\frac{5}{2}$ V, 8 V
2. $\frac{3}{2}$ V, 5 V
3. 3 V, 5 V
4. 5 V, 8 V

Q.2 The least count of the main scale of a vernier callipers is 1 mm. Its vernier scale is divided into 10 divisions and coincide with 9 divisions of the main scale. When jaws are touching each other, the 7^{th} division of vernier scale coincides with a division of main scale and the zero of vernier scale is lying right side of the zero of main scale. When this vernier is used to measure length of a cylinder the zero of the vernier scale between 3.1 cm and 3.2 cm and 4^{th} VSD coincides with a main scale division. The length of the cylinder is : (VSD is vernier scale division)

Options

1. 3.21 cm
2. 3.07 cm
3. 2.99 cm
4. 3.2 cm

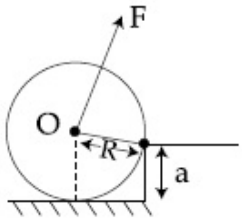
Q.3 A bead of mass m stays at point P(a, b) on a wire bent in the shape of a parabola $y = 4Cx^2$ and rotating with angular speed ω (see figure). The value of ω is (neglect friction) :



Options

1. $2\sqrt{gC}$
2. $2\sqrt{2gC}$
3. $\sqrt{\frac{2g}{C}}$
4. $\sqrt{\frac{2gC}{ab}}$

Q.4 A uniform cylinder of mass M and radius R is to be pulled over a step of height a (a < R) by applying a force F at its centre 'O' perpendicular to the plane through the axes of the cylinder on the edge of the step (see figure). The minimum value of F required is :



Options

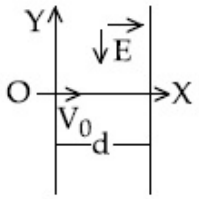
1. $Mg\sqrt{\left(\frac{R}{R-a}\right)^2-1}$
2. $Mg\frac{a}{R}$
3. $Mg\sqrt{1-\frac{a^2}{R^2}}$
4. $Mg\sqrt{1-\left(\frac{R-a}{R}\right)^2}$

Q.5 A beam of protons with speed 4×10^5 ms^{-1} enters a uniform magnetic field of 0.3 T at an angle of 60° to the magnetic field. The pitch of the resulting helical path of protons is close to : (Mass of the proton $= 1.67 \times 10^{-27}$ kg, charge of the proton $= 1.69 \times 10^{-19}$ C)

Options
1. 12 cm
2. 4 cm
3. 5 cm
4. 2 cm

Q.6

A charged particle (mass m and charge q) moves along X axis with velocity V_0. When it passes through the origin it enters a region having uniform electric field $\vec{E} = -E\hat{j}$ which extends upto $x = d$. Equation of path of electron in the region $x > d$ is :



Options

1. $y = \frac{qEd}{mV_0^2}\left(\frac{d}{2} - x\right)$

2. $y = \frac{qEd^2}{mV_0^2}x$

3. $y = \frac{qEd}{mV_0^2}x$

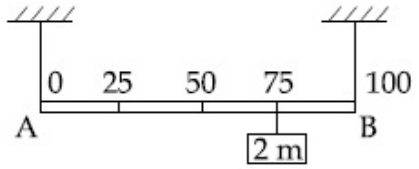
4. $y = \frac{qEd}{mV_0^2}(x - d)$

Q.7 If speed V, area A and force F are chosen as fundamental units, then the dimension of Young's modulus will be :

Options

1. $FA^{-1}V^{0}$
2. $FA^{2}V^{-2}$
3. $FA^{2}V^{-3}$
4. $FA^{2}V^{-1}$

Q.8



Shown in the figure is rigid and uniform one meter long rod AB held in horizontal position by two strings tied to its ends and attached to the ceiling. The rod is of mass 'm' and has another weight of mass 2 m hung at a distance of 75 cm from A. The tension in the string at A is :

Options

1. 1 mg
2. 0.75 mg
3. 2 mg
4. 0.5 mg

Q.9 Interference fringes are observed on a screen by illuminating two thin slits 1 mm apart with a light source ($\lambda = 632.8$ nm). The distance between the screen and the slits is 100 cm. If a bright fringe is observed on a screen at a distance of 1.27 mm from the central bright fringe, then the path difference between the waves, which are reaching this point from the slits is close to :

Options

1. 2 nm
2. 2.05 μm
3. 2.87 nm
4. 1.27 μm

Q.10 Consider four conducting materials copper, tungsten, mercury and aluminium with resistivity ρ_C , ρ_T , ρ_M and ρ_A respectively. Then :

Options

1. $\rho_A > \rho_M > \rho_C$
2. $\rho_C > \rho_A > \rho_T$
3. $\rho_A > \rho_T > \rho_C$
4. $\rho_M > \rho_A > \rho_C$

Q.11 Two identical strings X and Z made of same material have tension T_X and T_Z in them. If their fundamental frequencies are 450 Hz and 300 Hz, respectively, then the ratio T_X/T_Z is :

Options

1. 0.44
2. 2.25
3. 1.25
4. 1.5

Q.12 Train A and train B are running on parallel tracks in the opposite directions with speeds of 36 km/hour and 72 km/hour, respectively. A person is walking in train A in the direction opposite to its motion with a speed of 1.8 km/hour. Speed (in ms^{-1}) of this person as observed from train B will be close to : (take the distance between the tracks as negligible)

Options

1. 30.5 ms^{-1}
2. 28.5 ms^{-1}
3. 29.5 ms^{-1}
4. 31.5 ms^{-1}

Q.13 A particle of mass m with an initial velocity $u\hat{i}$ collides perfectly elastically with a mass 3m at rest. It moves with a velocity $v\hat{j}$ after collision, then, v is given by :

Options

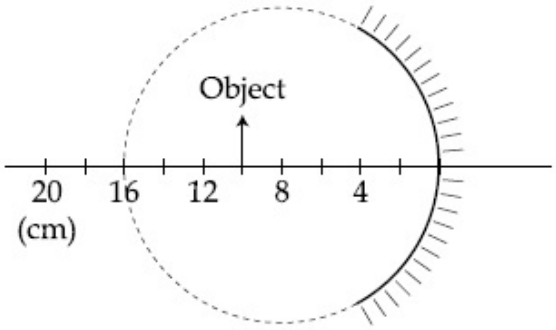
1. $v = \frac{u}{\sqrt{2}}$
2. $v = \sqrt{\frac{2}{3}}\,u$
3. $v = \frac{u}{\sqrt{3}}$
4. $v = \frac{1}{\sqrt{6}}\,u$

Q.14 Magnetic materials used for making permanent magnets (P) and magnets in a transformer (T) have different properties of the following, which property best matches for the type of magnet required ?

Options

1. T : Large retentivity, large coercivity
2. P : Large retentivity, large coercivity
3. T : Large retentivity, small coercivity
4. P : Small retentivity, large coercivity

Q.15



A spherical mirror is obtained as shown in the figure from a hollow glass sphere. If an object is positioned in front of the mirror, what will be the nature and magnification of the image of the object ? (Figure drawn as schematic and not to scale)

Options

1. Inverted, real and unmagnified
2. Inverted, real and magnified
3. Erect, virtual and magnified
4. Erect, virtual and unmagnified

Q.16 In a reactor, 2 kg of $_{92}U^{235}$ fuel is fully used up in 30 days. The energy released per fission is 200 MeV. Given that the Avogadro number, $N = 6.023 \times 10^{26}$ per kilo mole and 1 eV $= 1.6 \times 10^{-19}$ J. The power output of the reactor is close to :

Options
1. 60 MW
2. 125 MW
3. 54 MW
4. 35 MW

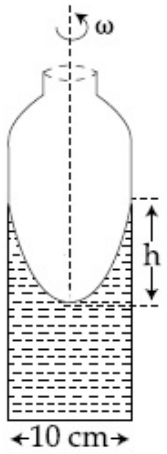
Q.17 The mass density of a spherical galaxy varies as $\frac{K}{r}$ over a large distance 'r' from its centre. In that region, a small star is in a circular orbit of radius R. Then the period of revolution, T depends on R as :

Options
1. $T^2 \propto \frac{1}{R^3}$
2. $T \propto R$
3. $T^2 \propto R^3$
4. $T^2 \propto R$

Q.18 A plane electromagnetic wave, has frequency of 2.0×10^{10} Hz and its energy density is $1.02\times10^{-8}\,J/m^3$ in vacuum. The amplitude of the magnetic field of the wave is close to ($\frac{1}{4\pi\epsilon_0}=9\times10^9\ \frac{Nm^2}{C^2}$ and speed of light $=3\times10^8\ ms^{-1}$):

Options
1. 190 nT
2. 160 nT
3. 150 nT
4. 180 nT

Q.19 A cylindrical vessel containing a liquid is rotated about its axis so that the liquid rises at its sides as shown in the figure. The radius of vessel is 5 cm and the angular speed of rotation is ω rad s^{-1}. The difference in the height, h (in cm) of liquid at the centre of vessel and at the side will be :



Options

1. $\frac{25\,\omega^2}{2\,g}$
2. $\frac{2\,\omega^2}{5\,g}$
3. $\frac{5\,\omega^2}{2\,g}$
4. $\frac{2\,\omega^2}{25\,g}$

Q.20 A gas mixture consists of 3 moles of oxygen and 5 moles of argon at temperature T. Assuming the gases to be ideal and the oxygen bond to be rigid, the total internal energy (in units of RT) of the mixture is :

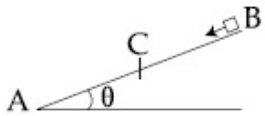
Options
1. 13
2. 11
3. 15
4. 20

Q.21 An engine takes in 5 moles of air at 20°C and 1 atm, and compresses it adiabaticaly to $1/10^{th}$ of the original volume. Assuming air to be a diatomic ideal gas made up of rigid molecules, the change in its internal energy during this process comes out to be X kJ. The value of X to the nearest integer is _____.

Q.22 A circular coil of radius 10 cm is placed in a uniform magnetic field of 3.0×10^{-5} T with its plane perpendicular to the field initially. It is rotated at constant angular speed about an axis along the diameter of coil and perpendicular to magnetic field so that it undergoes half of rotation in 0.2s. The maximum value of EMF induced (in μV) in the coil will be close to the integer _____.

Q.23 When radiation of wavelength λ is used to illuminate a metallic surface, the stopping potential is V. When the same surface is illuminated with radiation of wavelength 3λ, the stopping potential is $\frac{V}{4}$. If the threshold wavelength for the metallic surface is $n\lambda$ then value of n will be _____.

Q.24



A small block starts slipping down from a point B on an inclined plane AB, which is making an angle θ with the horizontal section BC is smooth and the remaining section CA is rough with a coefficient of friction μ. It is found that the block comes to rest as it reaches the bottom (point A) of the inclined plane. If BC = 2AC, the coefficient of friction is given by $\mu = k \tan\theta$. The value of k is _____.

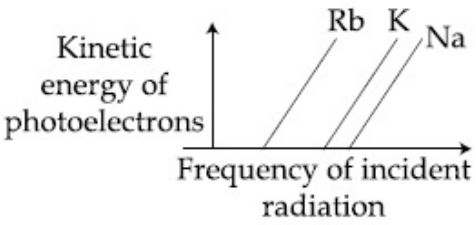
Q.25

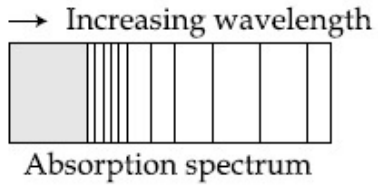
A 5 μF capacitor is charged fully by a 220 V supply. It is then disconnected from the supply and is connected in series to another uncharged 2.5 μF capacitor. If the energy change during the charge redistribution is $\frac{X}{100}$ J then value of X to the nearest integer is _____.

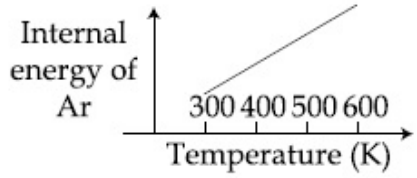
CHEMISTRY

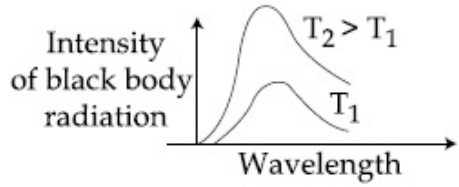
Q.1 The figure that is not a direct manifestation of the quantum nature of atoms is :

Options

1. 

2. 

3. 

4. 

Q.2 Consider the following reactions :

(i) Glucose+ROH $\xrightarrow{\text{dry HCl}}$ Acetal $\xrightarrow{x \text{ eq. of } (CH_3CO)_2O}$ acetyl derivative

(ii) Glucose $\xrightarrow{Ni/H_2}$ A $\xrightarrow{y \text{ eq. of } (CH_3CO)_2O}$ acetyl derivative

(iii) Glucose $\xrightarrow{z \text{ eq. of } (CH_3CO)_2O}$ acetyl derivative

'x', 'y' and 'z' in these reactions are respectively.

Options

1. 5, 6 & 5
2. 5, 4 & 5
3. 4, 5 & 5
4. 4, 6 & 5

Q.3 Consider that a d^6 metal ion (M^{2+}) forms a complex with aqua ligands, and the spin only magnetic moment of the complex is 4.90 BM. The geometry and the crystal field stabilization energy of the complex is :

Options
1. octahedral and $-2.4\Delta_0 + 2P$
2. octahedral and $-1.6\,\Delta_0$
3. tetrahedral and $-0.6\Delta_t$
4. tetrahedral and $-1.6\Delta_t + 1P$

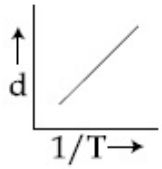
Q.4 In general, the property (magnitudes only) that shows an opposite trend in comparison to other properties across a period is :

Options
1. Ionization enthalpy
2. Atomic radius
3. Electronegativity
4. Electron gain enthalpy

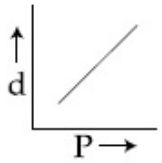
Q.5 Which one of the following graphs is not correct for ideal gas ?

I

II



III



IV

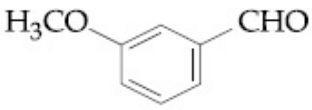
d = Density, P = Pressure, T = Temperature

Options

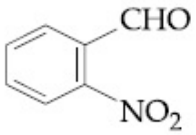
1. IV
2. II
3. III
4. I

Q.6

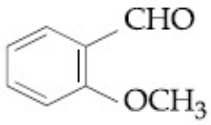
The increasing order of the following compounds towards HCN addition is :



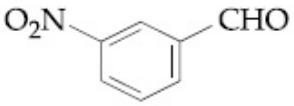
(i)



(ii)



(iii)



(iv)

Options

1. (iii) < (iv) < (i) < (ii)
2. (i) < (iii) < (iv) < (ii)
3. (iii) < (iv) < (ii) < (i)
4. (iii) < (i) < (iv) < (ii)

Q.7

If AB_4 molecule is a polar molecule, a possible geometry of AB_4 is :

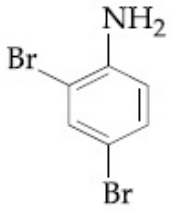
Options

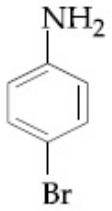
1. Square pyramidal
2. Tetrahedral
3. Rectangular planar
4. Square planar

Q.8 In Carius method of estimation of halogen, 0.172 g of an organic compound showed presence of 0.08 g of bromine. Which of these is the correct structure of the compound ?

Options

1. H_3C-Br

2. 

3. 

4. H_3C-CH_2-Br

Q.9 For octahedral Mn(II) and tetrahedral Ni(II) complexes, consider the following statements :

(I) both the complexes can be high spin.

(II) Ni(II) complex can very rarely be low spin.

(III) with strong field ligands, Mn(II) complexes can be low spin.

(IV) aqueous solution of Mn(II) ions is yellow in color.

The correct statements are :

Options

1. (II), (III) and (IV) only
2. (I) and (II) only
3. (I), (II) and (III) only
4. (I), (III) and (IV) only

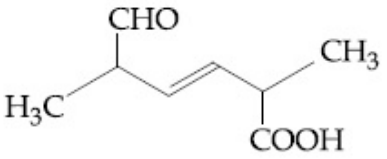
Q.10 On heating compound (A) gives a gas (B) which is a constituent of air. This gas when treated with H_2 in the presence of a catalyst gives another gas (C) which is basic in nature. (A) should not be :

Options
1. $Pb(NO_3)_2$
2. NaN_3
3. $(NH_4)_2Cr_2O_7$
4. NH_4NO_2

Q.11 An open beaker of water in equilibrium with water vapour is in a sealed container. When a few grams of glucose are added to the beaker of water, the rate at which water molecules :

Options
1. leaves the solution decreases
2. leaves the vapour increases
3. leaves the solution increases
4. leaves the vapour decreases

Q.12 The IUPAC name for the following compound is :

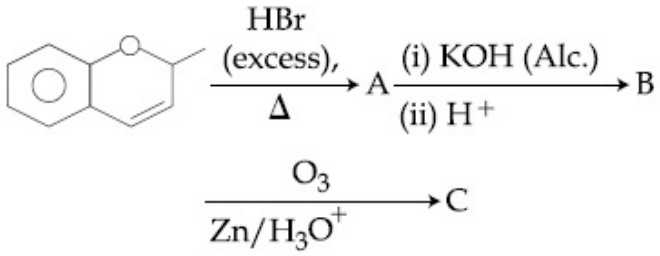


Options

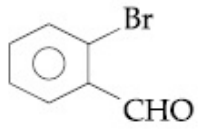
1. 2, 5-dimethyl-6-carboxy-hex-3-enal
2. 2, 5-dimethyl-6-oxo-hex-3-enoic acid
3. 6-formyl-2-methyl-hex-3-enoic acid
4. 2, 5-dimethyl-5-carboxy-hex-3-enal

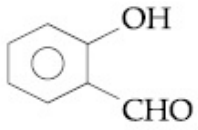
Q.13

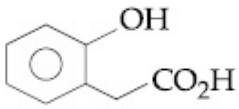
The major aromatic product C in the following reaction sequence will be :

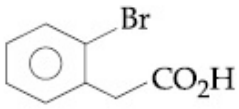


Options

1. 

2. 

3. 

4. 

Q.14 While titrating dilute HCl solution with aqueous NaOH, which of the following will not be required ?

Options
1. Burette and porcelain tile
2. Clamp and phenolphthalein
3. Bunsen burner and measuring cylinder
4. Pipette and distilled water

Q.15 The metal mainly used in devising photoelectric cells is :

Options
1. Cs
2. Rb
3. Li
4. Na

Q.16 For the following **Assertion** and **Reason**, the correct option is

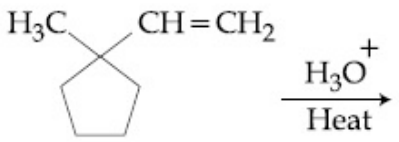
Assertion (A) : When Cu (II) and sulphide ions are mixed, they react together extremely quickly to give a solid.

Reason (R) : The equilibrium constant of $Cu^{2+}(aq) + S^{2-}(aq) \rightleftharpoons CuS(s)$ is high because the solubility product is low.

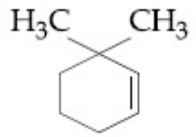
Options

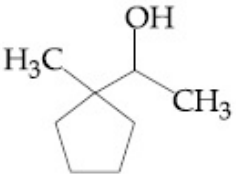
1. **(A)** is false and **(R)** is true.
2. Both **(A)** and **(R)** are true and **(R)** is the explanation for **(A)**.
3. Both **(A)** and **(R)** are false.
4. Both **(A)** and **(R)** are true but **(R)** is not the explanation for **(A)**.

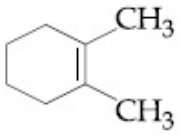
Q.17 The major product in the following reaction is :

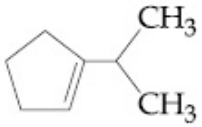


Options

1. 

2. 

3. 

4. 

Q.18 The statement that is not true about ozone is :

Options

1. in the stratosphere, it forms a protective shield against UV radiation.

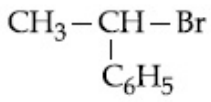
2. in the atmosphere, it is depleted by CFCs.

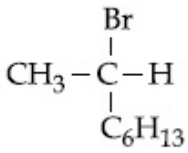
3. in the stratosphere, CFCs release chlorine free radicals ($Cl^{\cdot}$) which reacts with O_3 to give chlorine dioxide radicals.

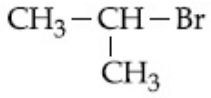
4. it is a toxic gas and its reaction with NO gives $NO_2^{\cdot}$

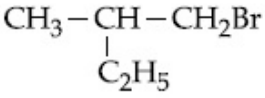
Q.19 Which of the following compounds will show retention in configuration on nucleophic substitution by OH^- ion ?

Options

1. 

2. 

3. 

4. 

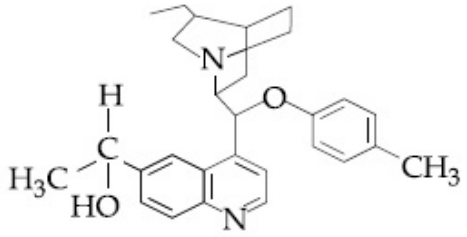
Q.20 Which of the following is used for the preparation of colloids ?

Options

1. Bredig's Arc Method
2. Van Arkel Method
3. Mond Process
4. Ostwald Process

Q.21 The mass of gas adsorbed, x, per unit mass of adsorbate, m, was measured at various pressures, p. A graph between $\log\frac{x}{m}$ and $\log p$ gives a straight line with slope equal to 2 and the intercept equal to 0.4771. The value of $\frac{x}{m}$ at a pressure of 4 atm is: (Given $\log 3 = 0.4771$)

Q.22 The number of chiral carbons present in the molecule given below is _____.



Q.23 The internal energy change (in J) when 90 g of water undergoes complete evaporation at 100°C is _____. (Given : ΔH_{vap} for water at 373 K = 41 kJ/mol, R = 8.314 JK^{-1} mol^{-1})

Q.24 The oxidation states of iron atoms in compounds (A), (B) and (C), respectively, are x, y and z. The sum of x, y and z is _____.

$Na_4[Fe(CN)_5(NOS)]$	$Na_4[FeO_4]$	$[Fe_2(CO)_9]$
(A)	(B)	(C)

Q.25 The Gibbs energy change (in J) for the given reaction at $[Cu^{2+}]=[Sn^{2+}]=1$ M and 298 K is :

$$Cu(s)+Sn^{2+}(aq.) \rightarrow Cu^{2+}(aq.)+Sn(s);$$

$(E^0_{Sn^{2+}|Sn} = -0.16$ V, $E^0_{Cu^{2+}|Cu} = 0.34$ V,

Take $F = 96500$ C mol^{-1})

MATHEMATICS

Q.1 Let S be the set of all $\lambda \in \mathbf{R}$ for which the system of linear equations

$2x - y + 2z = 2$

$x - 2y + \lambda z = -4$

$x + \lambda y + z = 4$

has no solution. Then the set S

Options

1. is a singleton.
2. contains more than two elements.
3. contains exactly two elements.
4. is an empty set.

Q.2 Let $\alpha > 0, \beta > 0$ be such that $\alpha^3 + \beta^2 = 4$. If the maximum value of the term independent of x in the binomial expansion of $\left(\alpha x^{\frac{1}{9}} + \beta x^{-\frac{1}{6}}\right)^{10}$ is 10 k, then k is equal to :

Options

1. 84
2. 176
3. 336
4. 352

Q.3 If the tangent to the curve $y = x + \sin y$ at a point (a, b) is parallel to the line joining $\left(0, \frac{3}{2}\right)$ and $\left(\frac{1}{2}, 2\right)$, then :

Options
1. $b = a$
2. $b = \frac{\pi}{2} + a$
3. $|a + b| = 1$
4. $|b - a| = 1$

Q.4 A line parallel to the straight line $2x - y = 0$ is tangent to the hyperbola $\frac{x^2}{4} - \frac{y^2}{2} = 1$ at the point (x_1, y_1). Then $x_1^2 + 5y_1^2$ is equal to :

Options
1. 8
2. 6
3. 10
4. 5

Q.5 Let A be a 2×2 real matrix with entries from $\{0, 1\}$ and $|A| \neq 0$. Consider the following two statements :

(P) If $A \neq I_2$, then $|A| = -1$

(Q) If $|A| = 1$, then $\text{tr}(A) = 2$,

where I_2 denotes 2×2 identity matrix and $\text{tr}(A)$ denotes the sum of the diagonal entries of A. Then :

Options
1. Both (P) and (Q) are false
2. Both (P) and (Q) are true
3. (P) is false and (Q) is true
4. (P) is true and (Q) is false

Q.6 Let $y = y(x)$ be the solution of the differential equation,

$\frac{2+\sin x}{y+1} \cdot \frac{dy}{dx} = -\cos x,\ y > 0,\ y(0) = 1$. If $y(\pi) = a$ and $\frac{dy}{dx}$ at $x = \pi$ is b, then the ordered pair (a, b) is equal to :

Options

1. $\left(2, \frac{3}{2}\right)$
2. $(2, 1)$
3. $(1, -1)$
4. $(1, 1)$

Q.7 Let $X = \{x \in \mathbf{N} : 1 \le x \le 17\}$ and $Y = \{ax + b : x \in X \text{ and } a, b \in \mathbf{R}, a > 0\}$. If mean and variance of elements of Y are 17 and 216 respectively then $a + b$ is equal to :

Options

1. 9
2. -27
3. 7
4. -7

Q.8 If $p(x)$ be a polynomial of degree three that has a local maximum value 8 at $x=1$ and a local minimum value 4 at $x=2$; then $p(0)$ is equal to :

Options

1. 12
2. 6
3. -24
4. -12

Q.9 Box I contains 30 cards numbered 1 to 30 and Box II contains 20 cards numbered 31 to 50. A box is selected at random and a card is drawn from it. The number on the card is found to be a non-prime number. The probability that the card was drawn from Box I is :

Options

1. $\frac{2}{3}$
2. $\frac{4}{17}$
3. $\frac{2}{5}$
4. $\frac{8}{17}$

Q.10 If a function $f(x)$ defined by

$$f(x)=\begin{cases} ae^{x}+be^{-x}, & -1\le x<1 \\ cx^{2}, & 1\le x\le 3 \\ ax^{2}+2cx, & 3<x\le 4 \end{cases}$$

be continuous for some a, b, c $\in$ **R** and $f'(0)+f'(2)=e$, then the value of a is :

Options

1. $\dfrac{e}{e^2-3e-13}$
2. $\dfrac{e}{e^2-3e+13}$
3. $\dfrac{e}{e^2+3e+13}$
4. $\dfrac{1}{e^2-3e+13}$

Q.11 Let α and β be the roots of the equation, $5x^2+6x-2=0$. If $S_n=\alpha^n+\beta^n$, $n=1,2,3,\ldots$, then :

Options

1. $6S_6+5S_5+2S_4=0$
2. $5S_6+6S_5+2S_4=0$
3. $6S_6+5S_5=2S_4$
4. $5S_6+6S_5=2S_4$

Q.12 The sum of the first three terms of a G.P. is S and their product is 27. Then all such S lie in :

Options

1. $(-\infty, -9] \cup [3, \infty)$
2. $(-\infty, -3] \cup [9, \infty)$
3. $(-\infty, 9]$
4. $[-3, \infty)$

Q.13 The plane passing through the points (1, 2, 1), (2, 1, 2) and parallel to the line, $2x = 3y,\ z = 1$ also passes through the point :

Options

1. $(0, 6, -2)$
2. $(2, 0, -1)$
3. $(0, -6, 2)$
4. $(-2, 0, 1)$

Q.14

The value of $\left(\frac{1+\sin\frac{2\pi}{9}+i\cos\frac{2\pi}{9}}{1+\sin\frac{2\pi}{9}-i\cos\frac{2\pi}{9}}\right)^3$ is :

Options

1. $\frac{1}{2}\left(1-i\sqrt{3}\right)$
2. $-\frac{1}{2}\left(\sqrt{3}-i\right)$
3. $-\frac{1}{2}\left(1-i\sqrt{3}\right)$
4. $\frac{1}{2}\left(\sqrt{3}-i\right)$

Q.15

The contrapositive of the statement "If I reach the station in time, then I will catch the train" is :

Options

1. If I will not catch the train, then I do not reach the station in time.
2. If I do not reach the station in time, then I will catch the train.
3. If I will catch the train, then I reach the station in time.
4. If I do not reach the station in time, then I will not catch the train.

Q.16 The domain of the function $f(x) = \sin^{-1}\left(\frac{|x|+5}{x^2+1}\right)$ is $(-\infty, -a] \cup [a, \infty)$. Then a is equal to :

Options

1. $\frac{\sqrt{17}-1}{2}$
2. $\frac{1+\sqrt{17}}{2}$
3. $\frac{\sqrt{17}}{2}$
4. $\frac{\sqrt{17}}{2}+1$

Q.17 Area (in sq. units) of the region outside $\frac{|x|}{2}+\frac{|y|}{3}=1$ and inside the ellipse $\frac{x^2}{4}+\frac{y^2}{9}=1$ is :

Options

1. $6(4-\pi)$
2. $3(4-\pi)$
3. $6(\pi-2)$
4. $3(\pi-2)$

Q.18 If $|x| < 1, |y| < 1$ and $x \neq y$, then the sum to infinity of the following series $(x+y)+(x^2+xy+y^2)+(x^3+x^2y+xy^2+y^3)+....$ is :

Options

1. $\frac{x+y-xy}{(1-x)(1-y)}$
2. $\frac{x+y+xy}{(1+x)(1+y)}$
3. $\frac{x+y+xy}{(1-x)(1-y)}$
4. $\frac{x+y-xy}{(1+x)(1+y)}$

Q.19 Let P(h, k) be a point on the curve $y=x^2+7x+2$, nearest to the line, $y=3x-3$. Then the equation of the normal to the curve at P is :

Options

1. $x+3y+26=0$
2. $x-3y+22=0$
3. $x-3y-11=0$
4. $x+3y-62=0$

Q.20 If $R=\{(x, y) : x, y \in \mathbf{Z}, x^2+3y^2 \leq 8\}$ is a relation on the set of integers $\mathbf{Z}$, then the domain of R^{-1} is :

Options
1. $\{-2, -1, 0, 1, 2\}$
2. $\{-2, -1, 1, 2\}$
3. $\{-1, 0, 1\}$
4. $\{0, 1\}$

Q.21 If the letters of the word 'MOTHER' be permuted and all the words so formed (with or without meaning) be listed as in a dictionary, then the position of the word 'MOTHER' is _____.

Q.22 If

$$\lim_{x\to 1}\frac{x+x^2+x^3+...+x^n-n}{x-1}=820,\ (n\in\mathbf{N})$$

then the value of n is equal to _____.

Q.23 Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three unit vectors such that $|\vec{a}-\vec{b}|^2+|\vec{a}-\vec{c}|^2=8$. Then $|\vec{a}+2\vec{b}|^2+|\vec{a}+2\vec{c}|^2$ is equal to _____.

Q.24 The number of integral values of k for which the line, $3x+4y=k$ intersects the circle, $x^2+y^2-2x-4y+4=0$ at two distinct points is _____.

Q.25 The integral $\int_0^2 \left||x-1|-x\right| dx$ is equal to _____.